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Light regime characterization in a photobioreactor for microalgae production using optical fibre technology

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The slow development of microalgal biotechnology is due to the failure in the design of large-scale photobioreactors (PBR) where light energy is efficiently utilized. In this work, both the quality and the amount of light reaching a given point of the PBR were determined and correlated with cell density, light path length and PBR geometry. This was made for two different geometries of the downcomer of an airlift PBR using optical fiber technology that allows obtaining information about quantitative and qualitative aspects of light patterns. This is important since the ability of microalgae to use the energy of photons is different, depending on the wavelength of the radiation. The results show that the circular geometry allows a more efficient light penetration, especially in the locations with a higher radial coordinate (*r*) when compared to the plane geometry; these observations were confirmed by the occurrence of a higher fraction of illuminated volume of the PBR for this geometry. An equation is proposed to correlate the relative light intensity (RLI) with the penetration distance (*Pd*), for both geometries and different microalgae cell concentrations. It was shown that the attenuation of light intensity is dependent on its wavelength, cell concentration, geometry of PBR and the penetration distance of light.